Thermal printing mechanism

MT2460

User's Manual

COD. DOME - MT2460 VERS. 1.00

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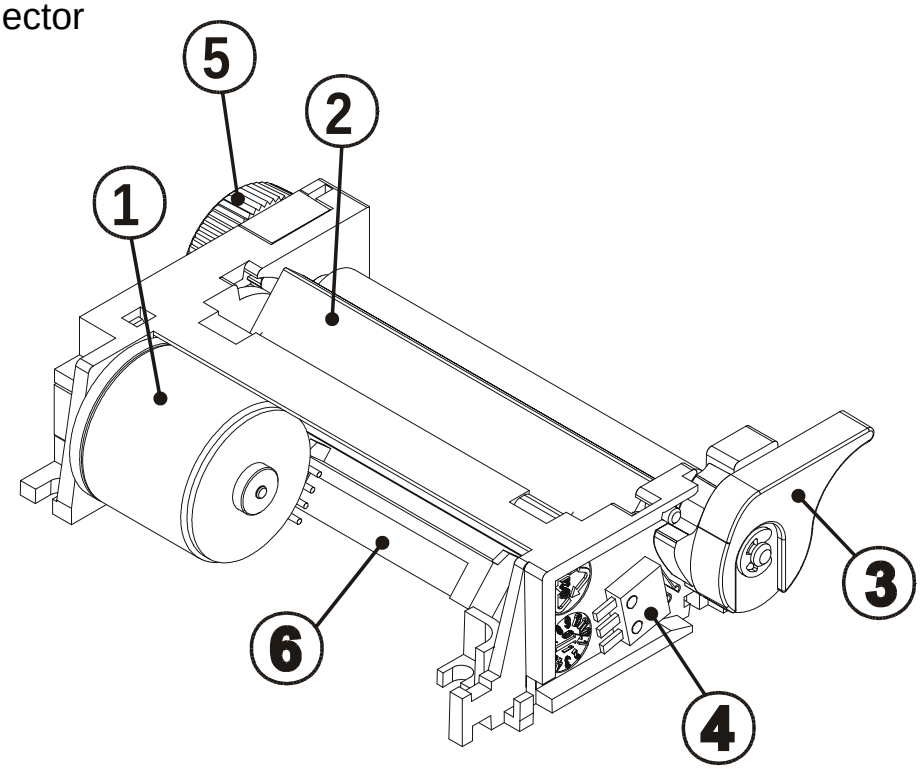
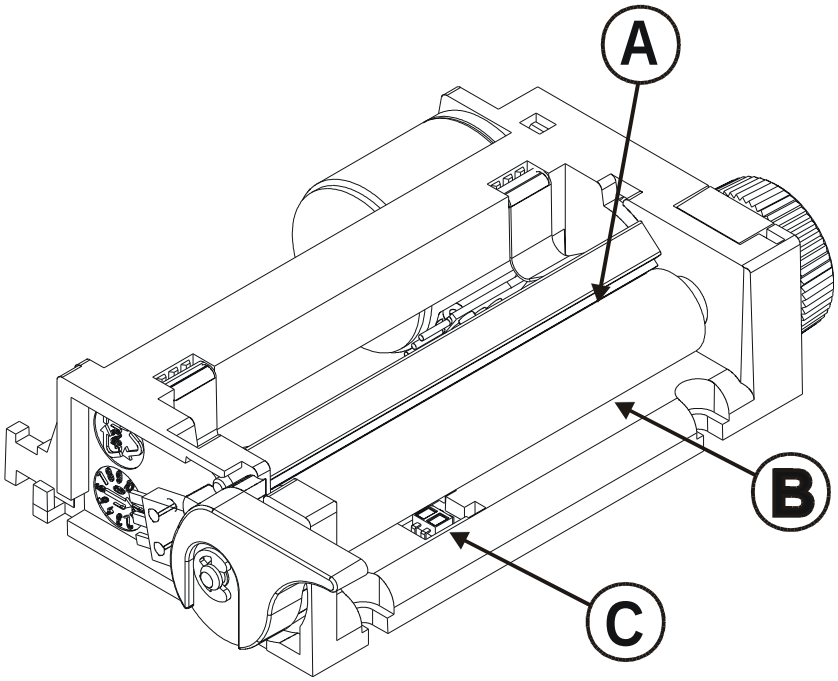
Printing mechanism models MT2460

A. Front exterior view MT2460

1- Motor
2- Print Head
3- Head up lever
4- Sensor Head up detection
5- Knob paper feed
6- Thermal head connector
A- Paper outfeed
B- Paper input
C- Paper end sensor





INTRODUCTION

1. CONNECTIONS

2. PRINT HEAD

3. STEPPER MOTOR

4. SENSOR

5. DIMENSIONS

CONVENTIONS USED IN THE MANUAL

N.B.
Gives important information or suggestions relative to the use of the printer

WARNING
The information marked with this symbol must be carefully heeded to safeguard against damaging the printer

DANGER
The information marked with this symbol must be carefully heeded to safeguard against injury to the operator.

GENERAL SPECIFICATIONS

(Tab. 1)

Item		Specification
Printing method		Thermal line dot method
Effective printing width		56mm ± 0,2mm
Head configuration (dots/line)		448
Dot Pitch		0.125 mm horizontal 0.125 mm vertical
Printing Speed (see power consumption and energy for dots)		150 mm/s
Paper width (mm)		60 ± 0,5
Paper feed method		Friction feed, 1 dot line/1 pulses, bipolar 2-2 phase excitation
Head temperature sensor		Thermistor
Paper detection		Reflective type photosensor
Maximum number of dots activated at a time		192
Dot resistance (Rav)		700 Ω ± 3%
Number of strobes		3
Header energy	5°C	0,165mJ/dot (0,22 ms)
	25°C	0,15mJ/dot (0,20 ms)
	40°C	0,14mJ/dot (0,19 ms)
Driver saturated resistance (Ric)		23 Ω
External dimensions (W x D x H)		85,4 x 49 x 20
Weight		72 gr.
Operation Voltage range logic		5V ± 10%
Operation Voltage dotline head		22,8 ÷ 25,2 V
Current consumption		31 mA/dots
Life/Reability		50 Km
Recommanded paper		Kanzan KF50 or equivalent

Maximum ratings

(Tab. 2)

Parameter	Specification
Head voltage	25,2 V (note between connectors)
Logic voltage	Vdd = +5V ± 0,25V
Environment operating temperature range	0 ÷ 50°C
Operating humidity	10 ÷ 90% RH no condensation
Storage environmental	-40 ÷ 80°C Humidity 10 ÷ 90% no condensation, Paper excluded
Maximum operating temperature	Detected temperature of thermistor shall not exceed 65°C

DESCRIPTION OF THE MECHANISM

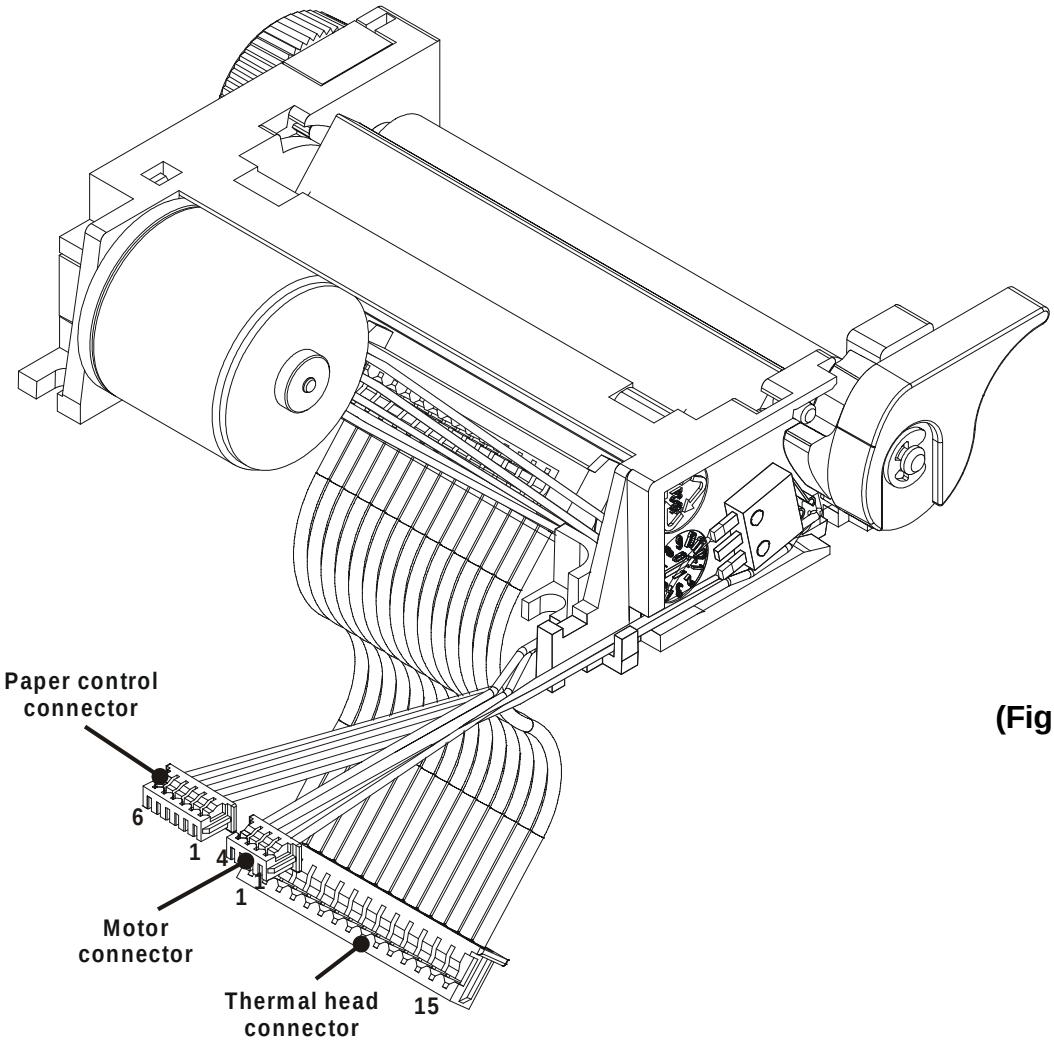
With the MT2460 mechanim Custom shows a new line of thermal plastic printing mechanisms; the new serie offers the possibility to achieve the high performances together with a very compact layout.

The MT2460 mechanisms prints at a high 203 dpi resolution on paper weights between 60 and 120 gr/m² (also labels).

The mechanism is featured with a high torque paper-pulling motor, and with a silicon rubber roll.

MAIN FEATURES

- Paper width from 60 mm.
- Autoloading capability.
- High printing speed up to 65 mm/sec.
- Logic voltage 24V.
- Possibility to manage paper thickness from 60 to 120 gr/m² (also labels).
- Sensors: Paper end sensor, head up detection, temperature sensor thermistor 30K.
- Life 50 Km Printed paper.
- Compact Layout.
- Double paper inlet : straight and 90°.
- Possibility to have the kit of integrated autocutter.
- New generation of printing head with a high performance.
- Options : Control board, notch sensor.



(Fig.1.1)

1.1 CONNECTIONS TERMINALS

The MT2460 mechanism has 3 interface connectors (see fig. 1.1), thermal head connector, motor connector and paper control connector. In the table below aredescribed the connector specifications and functions :

(Tab.1.1)

No.	Connector	Pin No.	Type
1	Thermal head connector	15	JST connector (or equivalent) Male S15B-PH-K-S
2	Head-up sensor	6	Molex connector (or equivalent) female housing 51021-0600 terminal 50058-800
	Paper end sensor		
3	Motor connector	4	Molex connector female housing 51021-0400(white) terminal 50058-8000

1.2 THERMAL HEAD CONNECTOR

1.2.1 Thermal Head connector's pin assignments

(Tab.1.2)

No.	Signal	Function
1	VH	HEAD POWER SUPPLY
2	VH	HEAD POWER SUPPLY
3	VH	HEAD POWER SUPPLY
4	GND	GROUND
5	GND	GROUND
6	GND	GROUND
7	VDD	LOGIC POWER SUPPLY
8	TM	THERMISTOR
9	STB1	STROBE1 SIGNAL
10	STB2	STROBE2 SIGNAL
11	STB3	STROBE3 SIGNAL
12	N.C.	NOT CONNECTED
13	CLOCK	SERIAL CLOCK
14	LATCH	LATCH
15	DATA IN	DATA INPUT

1.3 MOTOR CONNECTOR

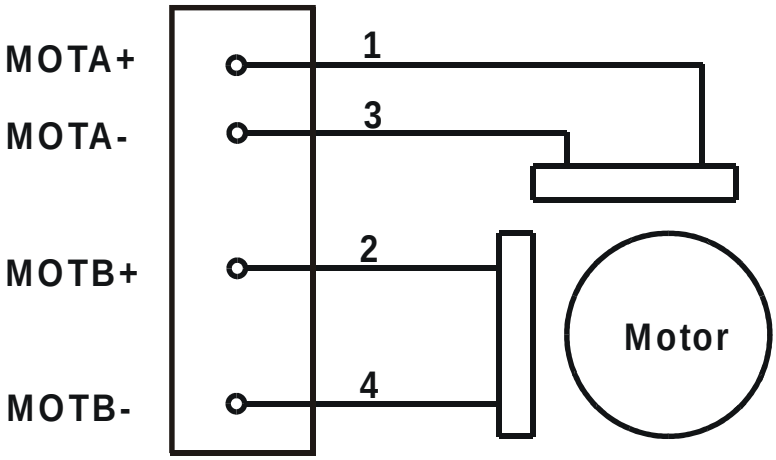
1.3.1 Motor connector's pin assignments

(Tab.1.3)

No.	Signal	Remarks
1	MOTA+	Phase 1 coil
2	MOTB+	Phase 2 coil
3	MOTA-	Phase 1 coil
4	MOTB-	Phase 2 coil

1.3.2 Electrical circuit block diagram of motor

(Fig.1.3)



1.4 PAPER END/HEAD-UP SENSOR CONNECTOR

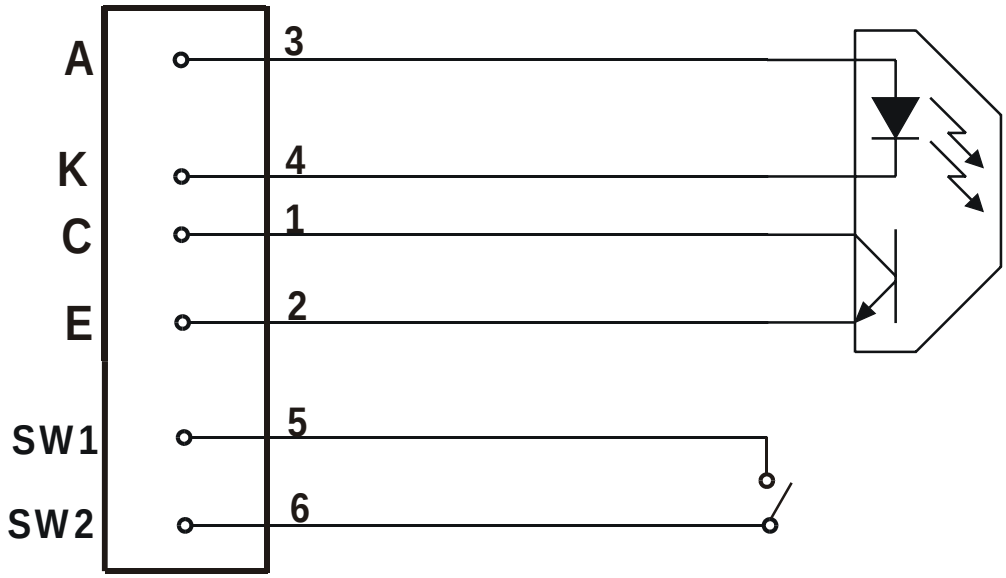
1.4.1 Paper end/Head-up sensor connector's pin assignments

(Tab.1.4)

No.	Signal	Remarks
1	Photo-transistor collector	Paper-end sensor
2	Photo-transistor emitter	
3	Led anode	
4	Led cathode	
5	Head-up sensor output	Head-up sensor
6	Head-up sensor output	

1.4.2 Electrical circuit block diagram of Paper end/Head-up sensor

(Fig.1.4)



2.1 PRINT HEAD

MT2460 has a thickfilm thermal printhead. Scanning Line Time (SLT) is the time to print one complete line using all strobes available.
The relation between the printhead supply voltage and “On Time” (Ton) is as follows:

$$Po = Io^2 \times Rav = \frac{VHead^2 \times Rav}{(Rav + Ric)^2}$$

$$Ton = \frac{Eo}{Po}$$

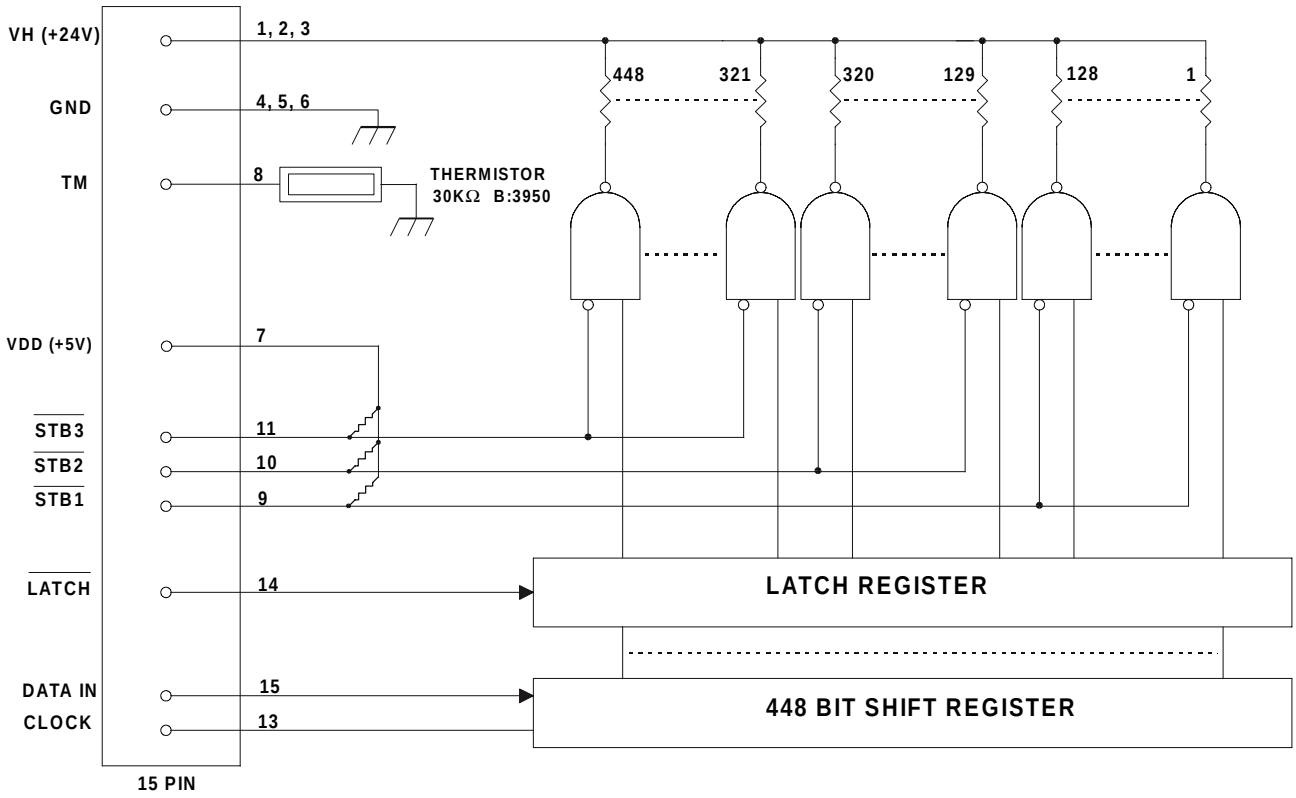
(Tab.2.1)

Symbol	Parameter	Unit
Rav	Average resistance	700 Ω
Ric	Driver Saturated Resistance	23 Ω

2.2 OPERATION PRECAUTIONS

1. When continuous printing is performed the supply energy should be reduced so that the substrate temperature show in Maximum Condition Table
2. Power On and Off sequence must be in the following order to prevent the dot element damage: Turn On= Apply the logic supply voltage (Vdd) first and then the printhead supply voltage. Turn Off= Switch off the printhead supply voltage first and then turn the logic voltage off.
3. The printhead shall be disabled in STB during Power ON/OFF, or Power (VH)-Logic(Vdd) sequence described in note 2 shall be kept.
4. Heat elements and IC’s shall be anti-electrostatic in order to prevent the electrostatic destruction. Do not touch the connector pins with naked hands.
5. The printhead substrate surface is coated with glass and mechanical stress or shock (including dust scratch damage) should be avoided to prevent damage.
6. When the printhead operation is finished, printsupply voltage (including the charged voltage with capacitor) should be reduced to the ground level and remained until next printhead operation occur.
7. Condensation should be avoided. If condensation occurred, do not switch on the printhead power until condensation disappear.
8. If printing sound, for example sticking sound, occured, please adjust the paper feed speed or pulse to avoid these kind of mechanical resonance.
9. Please pay attention that the paper used does not include bad factor to affect printhead life.
10. The print density variation may become larger if the number of dots energized at same time becomes greater than the 192 value.

2.3 BLOCK DIAGRAM OF THE ELECTRICAL CIRCUIT



(Fig.2.1)

Notes : ***Symbol " ——— ":****means a negative logic signal.*

2.3.1 Head Division Processing

The thermal head has 3 strobes, and print divide into up 3 times is possible. The relation between strobes and position of heting elements is shown in the following table :

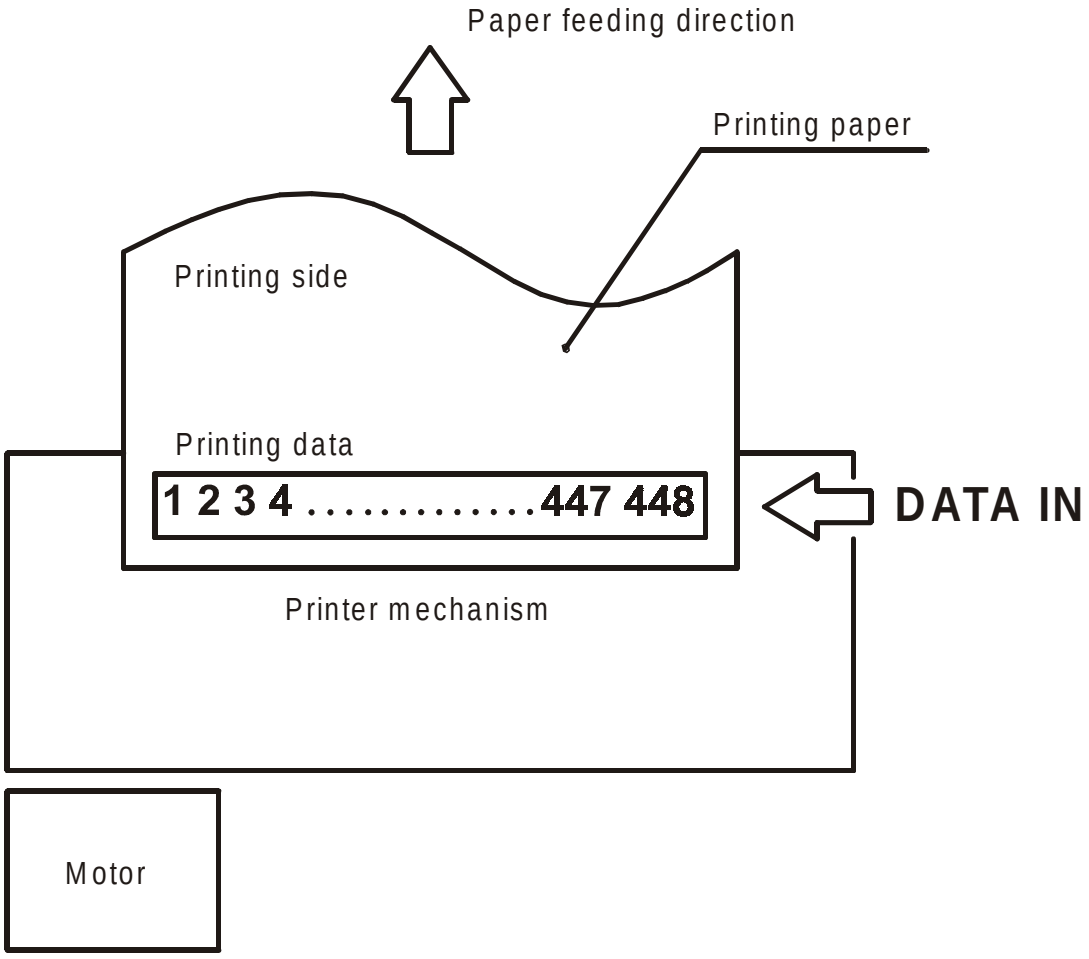
(Tab.2.2)

STB No.	Dot No.	Dots/STB
1	1 ~ 128	128
2	129 ~ 256	128
3	257 ~ 448	192

2.4 PRINTING DATA AND PRINTING POSITION

The data of 448 bits (1 to 448) transferred by DATA IN (DI) are printed in the arrangement as shown in the following figure :

(Fig.2.2)



2.5 ELECTRICAL CHARACTERISTICS OF CIRCUIT

(Tab.2.3)

Item	SYMBOL	MINI	TYP.	MAXI.	Unit
Head power supply	VH	23.5	24.0	24.5	V
Logic power supply	Vdd	4.75	5.0	5.25	V
Logic supply current	Idd	-	-	31.5	mA
Input Voltage (High)	VIH	0.8xVdd	-	Vdd	V
Input Voltage (Low)	VIL	0	-	0.2xVdd	V
Data input current (DI) High (1)	ILHDI	-	-	0.5	uA
Data input current (DI) Low	ILLDI	-	-	-0.5	uA
STB 1 to 3 input current (High) (1)	IIHSTR	-	-	1.5	uA
STB 1 to 3 input current (Low)	IILSTR	-	-	-165	uA
Clock input current (High) (1)	ILHCLK	-	-	3.5	uA
Clock input current (Low)	IILLCLK	-	-	-3.5	uA
Latch input current (High) (1)	IIHLAT	-	-	3.5	uA
Latch input current (Low)	IILLAT	-	-	-3.5	uA
Data out output voltage (High)	VDOH	4.45	-	-	V
Data out output voltage (Low)	VDOL	-	1.3	2.0	V
Clock frequency	f_{CLK}	0.1	1.0	3.5	MHz

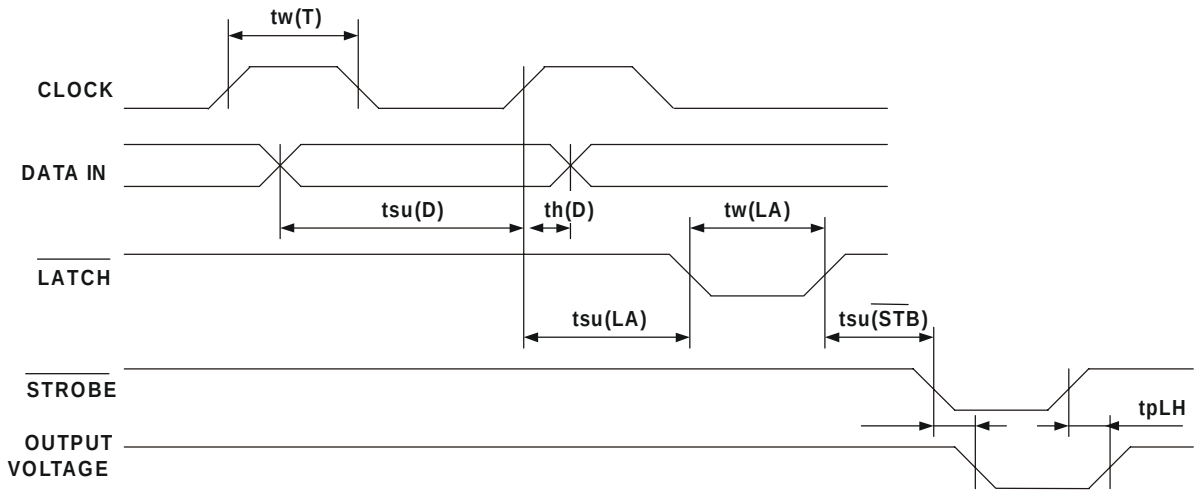
(1) ***Note**: Each strobe includes pull-up resistance of 300KΩ ± 50%.*

2.6 SWITCHING CHARACTERISTICS OF CIRCUIT

The switching characteristic summarized in the following table : **(Tab.2.4)**

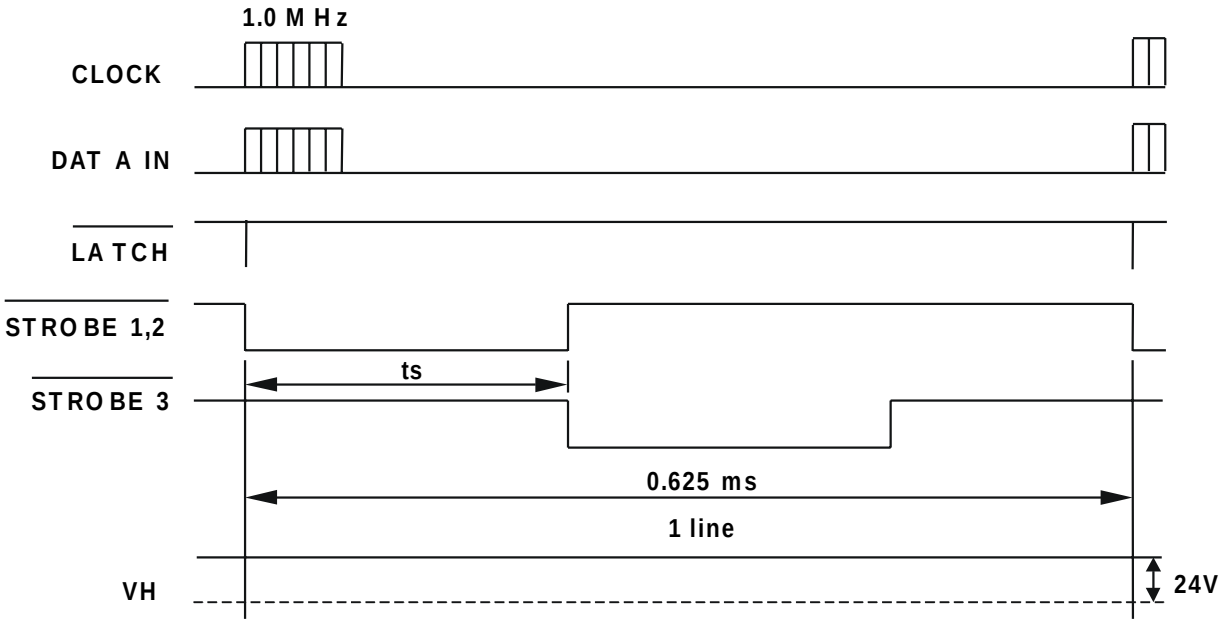
Item	SYMBOL	MINI	TYP.	MAXI.	Unit
Clock frequency	f_{MAX}	-	-	4.0	Mhz
Clock pulse width	tw(T)	70	-	-	ns
Data setup time	tsu(D)	50	-	-	ns
Data hold time	th(D)	40	-	-	ns
Latch setup time	tsu(LA)	100	-	-	ns
Latch pulse width	tw(LA)	100	-	-	ns
Strobe setup time	tsu(*STB*)	100	-	-	ns
Strobe to driver Otuput delay time	TpLH TpHL	-	-	3.5	µs

(Fig.2.3)



2.7 TIMING CHART

(Fig.2.4)



Notes : ***Symbol " ——— " :means a negative logic signal.***

2.8 THERMISTOR

The thermistor is very important to adjust the strobe time (Tstrobe) ~ (SLT) in function of the head temperature and to monitor the temperature to prevent the head damage if the temperature is over the limit described in the Maximum conditions table.

- Resistance R25 : 30 KΩ ± 5% at 25°C
- B value : 3950 K ± 2%
- Operating temperature : –20 ~ + 80°C
- Time costant : Max. 30 sec.(in the air)

Then the resistance value, R, versus temperature , T (in °C) is given by the formula :

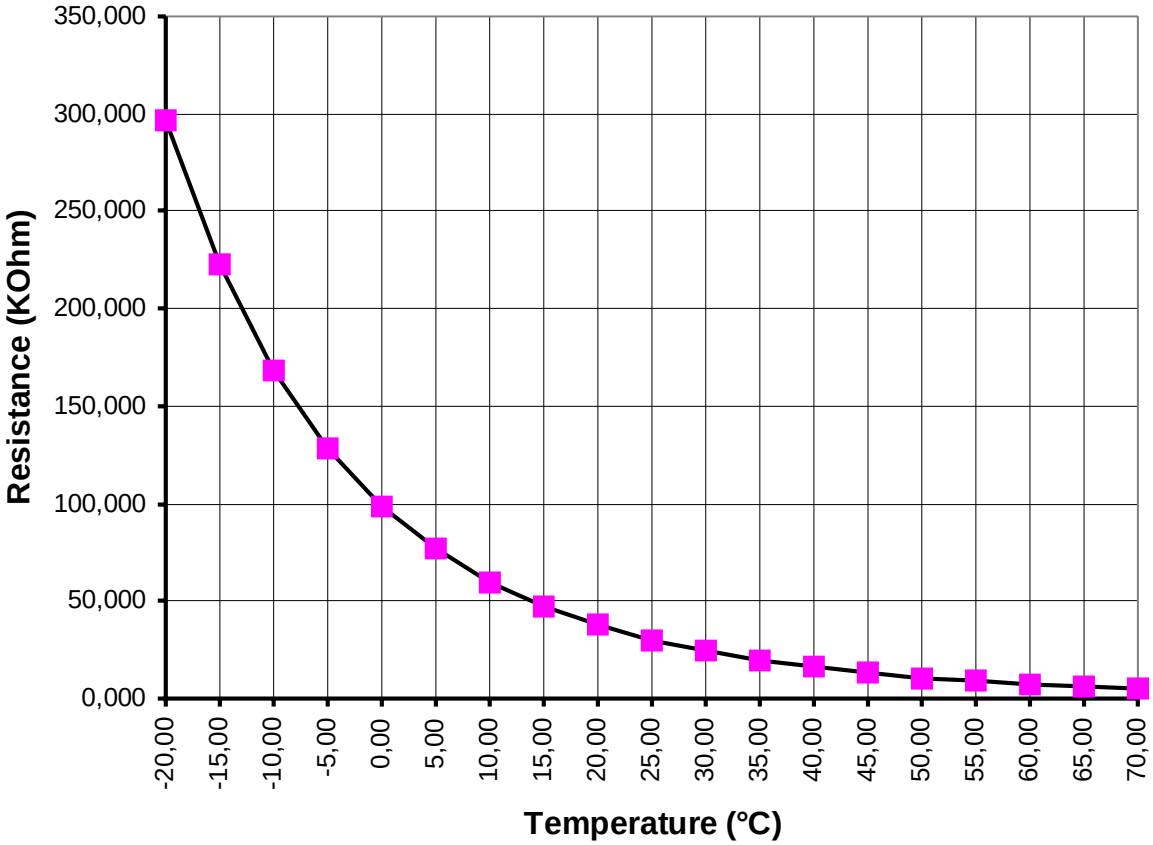
$$R(T) = R25 * e \{B*(1/TX – 1/T25)\}$$

(Tab.2.5)

Temperature (°C)	Thermistor Resistance (R)		
	MIN. (KΩ)	TYP. (KΩ)	MAX. (KΩ)
-20.0	268.8	296.6	326.5
-15.0	202.7	222.3	243.2
-10.0	154.2	168.2	182.9
-5.0	118.4	128.4	138.9
0.0	91.70	98.90	106.4
5.0	71.65	76.71	82.10
10.0	56.20	59.99	63.88
15.0	44.50	47.27	50.10
20.0	35.49	37.53	39.58
25.0	28.50	30.00	31.50
30.0	22.84	24.14	25.46
35.0	18.42	19.55	20.71
40.0	14.95	15.93	16.94
45.0	12.20	13.06	13.94
50.0	10.02	10.76	11.54
55.0	8.271	8.920	9.596
60.0	6.864	7.430	8.021
65.0	5.726	6.219	6.738
70.0	4.799	5.230	5.686

2.8.1 Thermistore Curves

(Fig.2.5)



3.1 STEPPER MOTOR

The paper feed pitch for stepper motor is 2 steps for one dotline(1).

(1) ***Note:*** *1 dotline = 0.125 mm.*

3.1.1 Technical specifications

(Tab.3.1)

Item	Specification
Drive voltage	DC 24 V
No. of phases	2
Drive mode	Bipolar drive
Step angle	18° ± 10%
Rated current	350 mA / Phase
Resistance	12Ω ± 7% at 25 °C (each phase)
Inductance	5.7 mH ± 25% at 25°C (1kHz. 1Vrms)
Holding torque	85 gf-cm MIN
Pull-out torque	45 gf–cm MIN
Insulation resistance	100 MΩ MIN (500 Vdc)
Insulation class	Class E
Dielectric strength	5 mA (at 600V AC 1.0 sec.)
Life	210 Hr min.
Maximum coil temperature	115°C

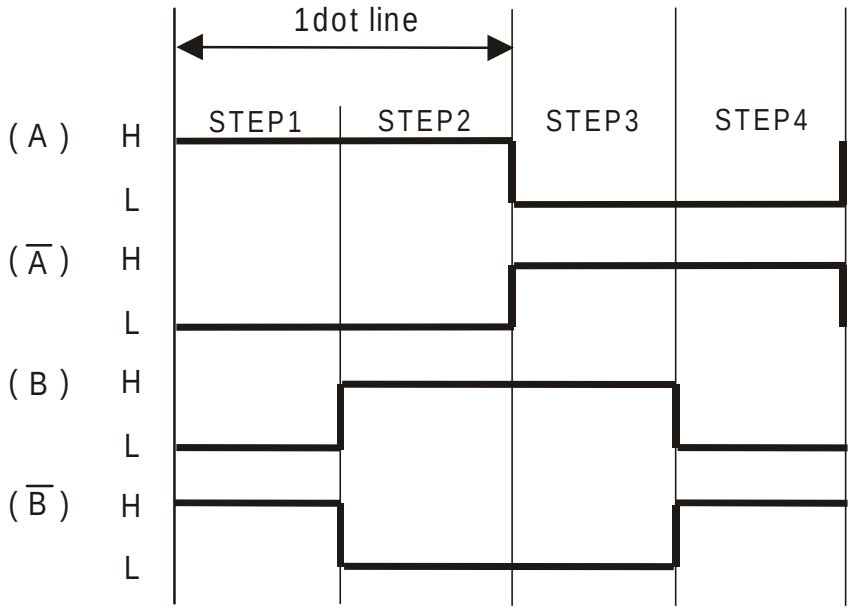
3.1.2 Excitation sequence

The motor is driven in the forward direction if its excitation phases are switched as per the following steps :

Sequence	Signal			
	A+	A-	B+	B-
Step1	High	Low	Low	High
Step2	High	Low	High	Low
Step3	Low	High	High	Low
Step4	Low	High	Low	High

(Tab.3.2)

Excitation Voltage Waveforms



(Fig.3.1)

3.2 PRECAUTION

1. Drive the motor with mosfet driver to obtain the maximum torque force instead transistor driver , transistor driver lose voltage VCEsat *2.

2. Please check the ratio print/pause to prevent the overtemperature on stepper motor.

3. If the motor is driven by more than 24 volts we suggest to use a chopper driving, in order to reduce current, please contact CUSTOM ENGINEERING SPA for further information.

4.1 SENSOR

Maximum Ratings (Ta = 25°C) (Tab.4.1)

Parameter		Symbol	Rating	Unit
LED	Forward current	I_F	50	mA
	Forward current derating (Ta > 25°C)	ΔI_F/°C	-0.67	mA/°C
	Pulse forward current (1)	I_{FP}	400	mA
	Reverse voltage	V_R	5	V
DETECTOR	Collector-emitter voltage	V_{CEO}	30	V
	Emitter-collector voltage	V_{ECO}	5	V
	Collector power dissipation	P_C	50	mW
	Collector power dissipation derating (Ta > 25°C)	ΔP_C/°C	-0.67	mW/°C
	Collector current	I_C	20	mA
Operating temperature range		T_{opr}	-25 ~ 85	°C
Storage temperature range		T_{stg}	-30 ~ 100	°C

(1) ***NOTE:*** *Pulse width 100 ≤ μs, Repetitive frequency = 100 Hz.*

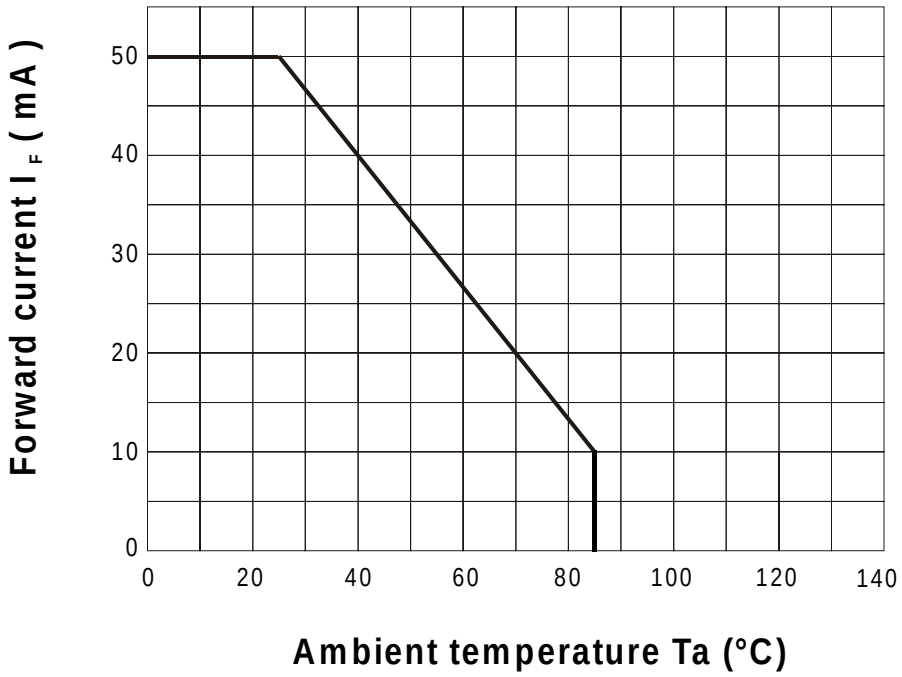
Opto-electrical characteristics (Ta = 25°C) (Tab.4.2)

Parameter		Symbol	Conditions	MIN.	TYP.	MAX.	Unit
LED	Forward voltage	V_F	I_F = 10mA	1.00	1.15	1.30	V
	Reverse current	I_R	V_R = 5V	-	-	10	μA
	Peak emission wavelength	λ_P	I_F = 10mA	-	940	-	nm
DETECTOR	Collector dark current	I_{CEO}	V_{CE} = 10V, I_F = 0	-	-	0.1	μA
	Peak sensibility wavelength	λ_P		-	900	-	nm
COUPLED	Collector current (2)	I_C	V_{CE} = 5V, I_F = 10mA	50	-	750	μA
	Leakage current	I_{LEAK}	V_{CE} = 5V, I_F = 10mA	-	-	0.1	μA
	Collector-emitter saturation voltage	$V_{CE\ (sat)}$	I_F = 10mA, I_C = 25μA	-	0.15	0.4	V
	Rise time	t_r	V_{CC} = 10V, I_C = 1 mA R_L = 1KΩ	-	10	-	μs
	Fall time	t_f		-	10	-	μs

(2) ***NOTE:*** *IC classification R: 50 ~ 150 μA, O : 110 ~ 330 μA.*

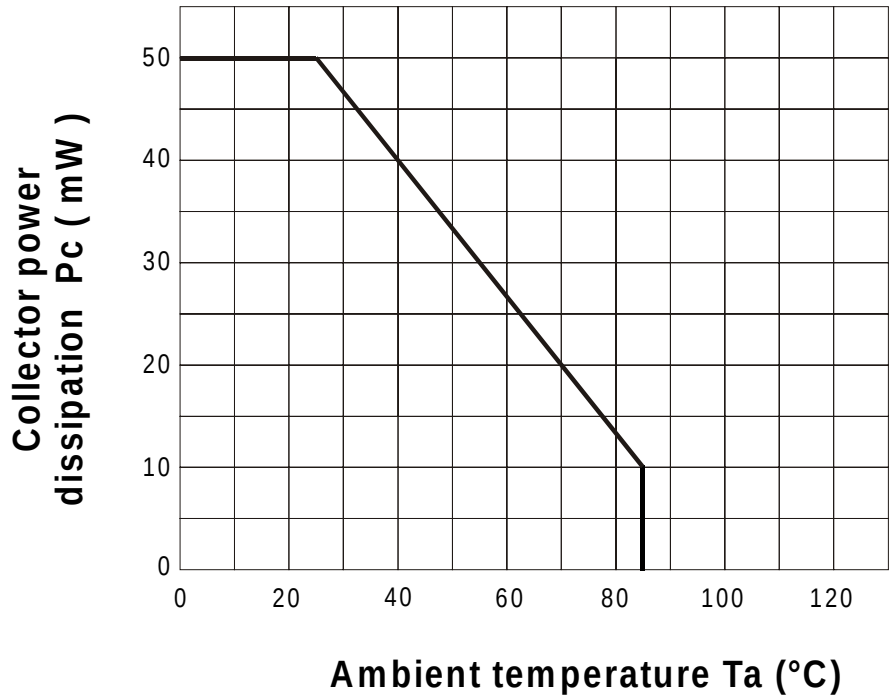
4.2 GRAPHICS OF TYPICAL CHARACTERISTICS

Forward Current vs. Ambient Temperature



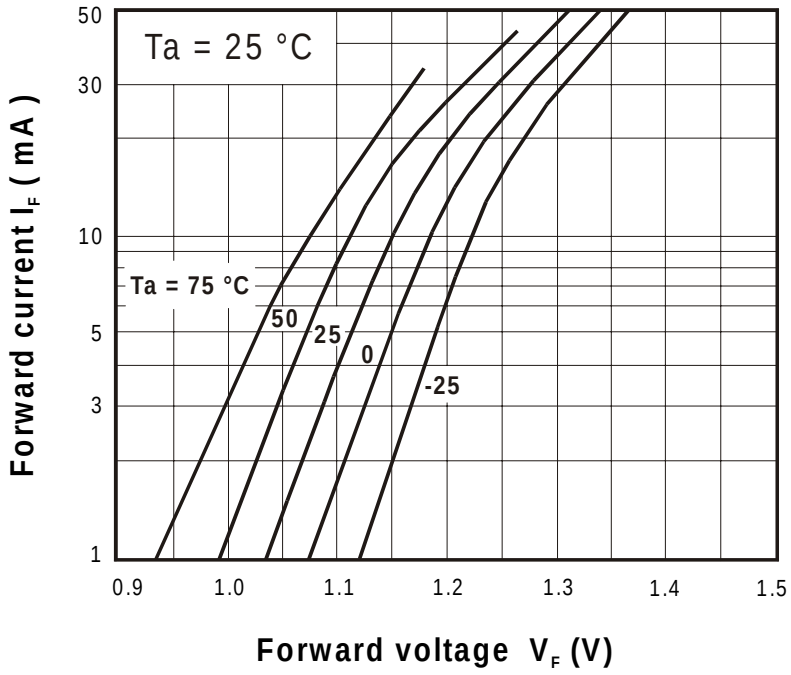
(Fig.4.1)

Collector Power dissipation vs. Ambient Temperature



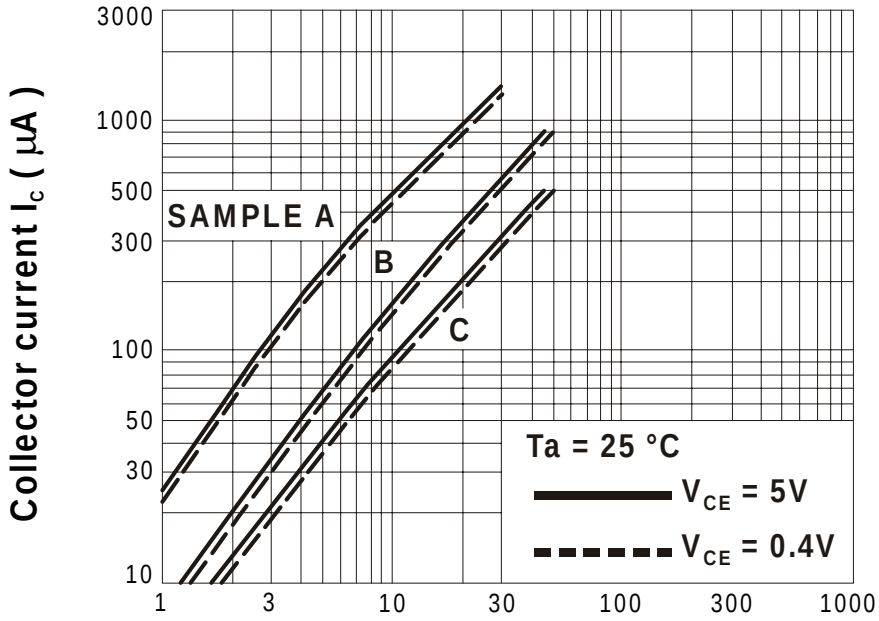
(Fig.4.2)

Forward Current vs. Forward Voltage



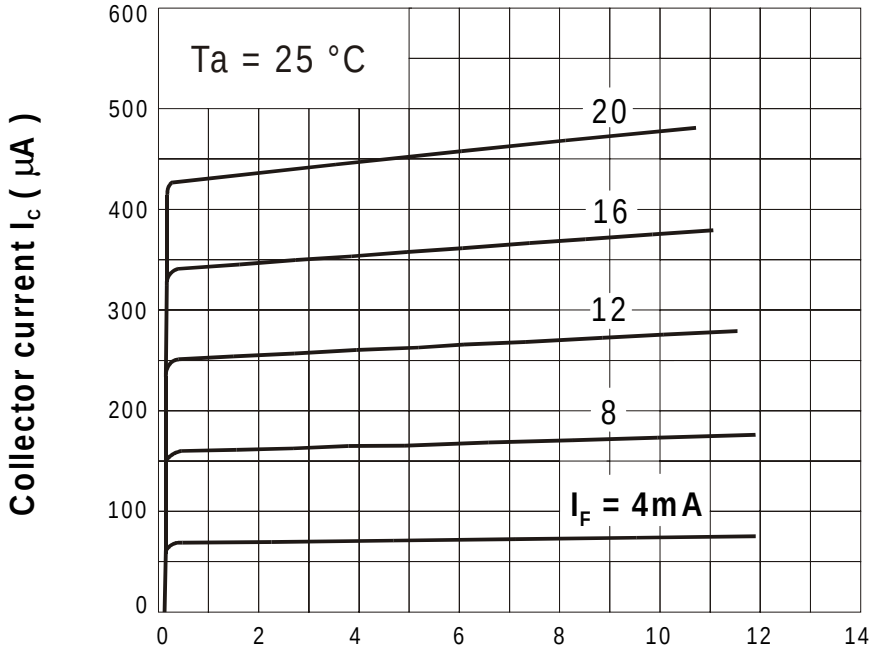
(Fig.4.3)

Collector Current vs. Forward Current



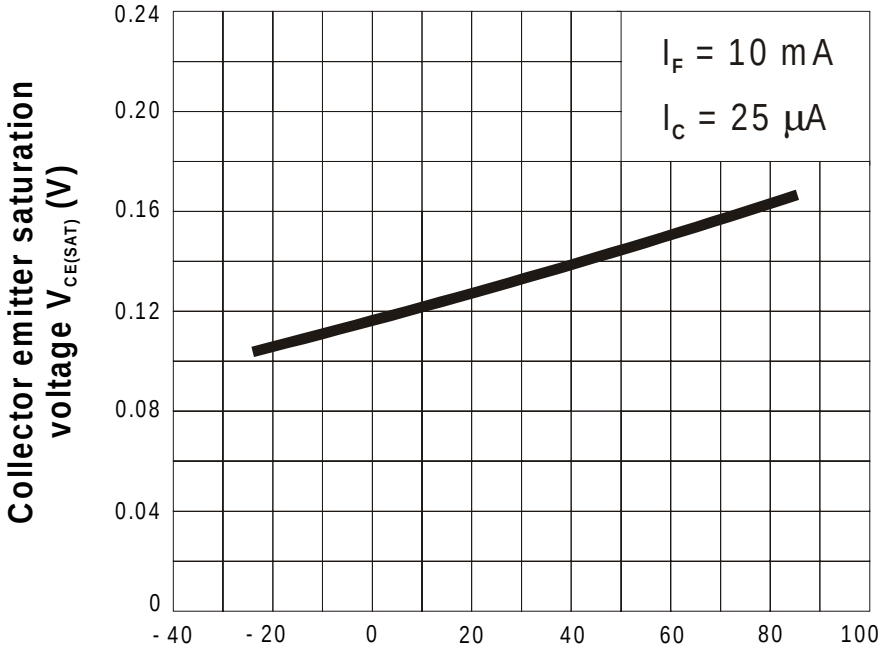
(Fig.4.4)

Collector Current vs. Collector-Emitter Voltage



(Fig.4.5)

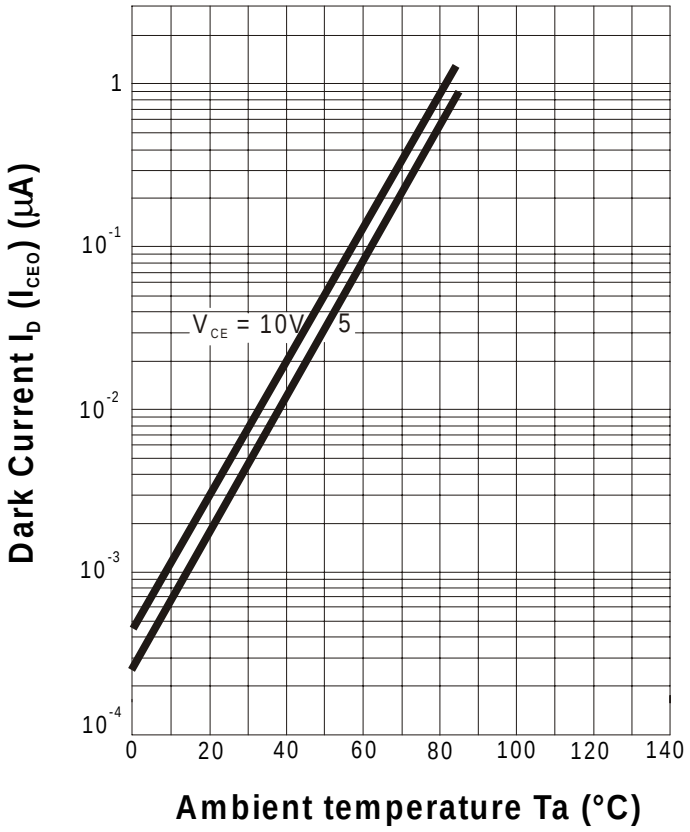
Collector-Emitter Saturation Voltage vs Ambient temperature



(Fig.4.6)

Dark current vs Ambient temperature

(Fig.4.7)



5.1 DIMENSIONS

The figure 5.1 illustrates the overall dimensions for the MT2460 thermal printing mechanism.

(Dimensions in mm) **(Fig.5.1)**